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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/708,748

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Wei Lu

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EXAMINER

JOHNSTON, PHILLIP A

ART UNIT

PAPER NUMBER

2881

DATE MAILED: 02/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/708,748

Applicant(s)

LU ET AL.

Examiner

Phillip A. Johnston

Art Unit

2881

AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5-10 and 12-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-10 and 12-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

Detailed Action

1. This Office Action is submitted in response to amendment dated 11-22-2005, wherein claims 4 and 11 are cancelled and claims 1 and 11 have been amended. Claims 1-3, 5-10, and 12-20 are pending.

Claims Rejection - 35 U.S. C. 102

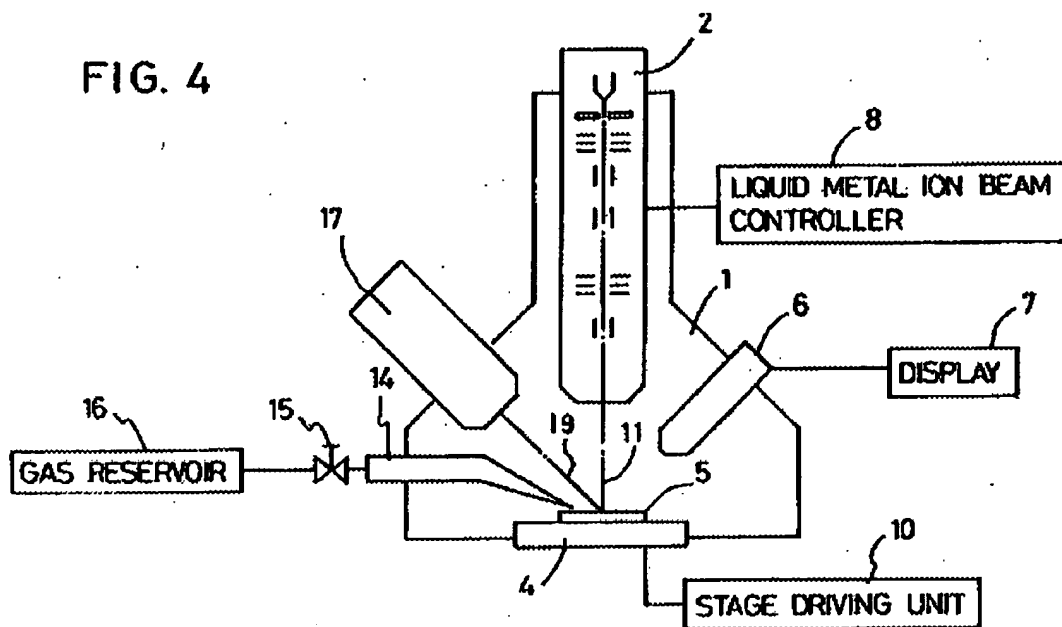
2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

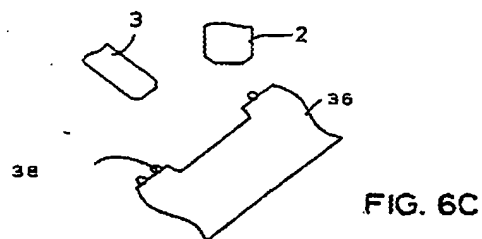
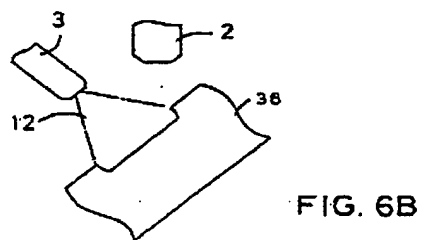
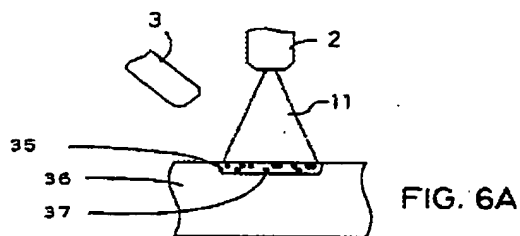
3. Claims 1-5, 8-12, and 15-18 stand rejected under 35 U.S.C. 102 (b) as being clearly anticipated by Fujii, U. S. Patent No. 5,574,280.

Fujii (280) discloses the following;

(a) Use of electron beam irradiation unit 17 to irradiate hexacarbonyl tungsten gas (organic metal gas) blown by the organic gas source 14 onto the surface of semiconductor device 5, and while irradiated with the energy beam source 17 a tungsten film is formed on the surface. A portion of the sample 5 at the predetermined area is removed (forms a groove) by ion beam sputtering, exposing the cross-section (e.g. wiring at the boundary) of the semiconductor. Subsequent irradiation at the section with the focused ion beam generates secondary particles, which are detected by a detector 6, and then the image of the section is displayed on the display 7 (inspecting the exposed area), as recited in claims 1, 8, and 15. See Column 2, line 40-49; Column 4, line 34-45; Column 5, line 47-57; and Figure 4 below;



(b) The use of a tilted stage shown in Figures 6A-6C; as recited in claims 2,3, and 10. See Figures 6A-6C below;



It is implied herein that, secondary electrons are generated when electron beam source 17 irradiates semiconductor sample 5, and these generated secondary electrons, along with the primary beam electrons, contribute to the dissociation (breakdown) of the organic gas, which results in deposition of the metal coating onto the semiconductor surface, as recited in claims 4, 11, and 15.

It is also implied herein that, secondary electrons always have less energy than the primary electrons that generate them, as recited in claims 5 and 12.

Claims Rejection – 35 U.S.C. 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 7, 14, and 20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,574,280 to Fujii, in view of Berger, U.S. Patent Pub. No. 20040065826.

Fujii (280) as described above discloses nearly all the limitations of claims 7, 14, and 20 but fails to teach the use of an incident electron beam angle between 20 and 70 degrees relative to the sample surface. However Berger (826) discloses a particle-beam system 10 for obtaining an image of a cross-section of a workpiece 11, as

shown in FIG. 1, includes a shaped-beam ion-projection column 12 configured to project an image of an aperture onto the front surface 14 of the workpiece 11, and further includes a focused-particle-beam imaging column 20, which is an electron beam provided by a scanning electron microscope. The column 20 is oriented along a second axis 22 that is canted relative to the first axis 18 so that it intersects the first axis 18 at a selected angle. The selected angle is preferably between thirty and sixty degrees, as recited in claims 7, 14, and 20. See paragraph's [0024], [0025]; [0039]; and Figure 1 below;

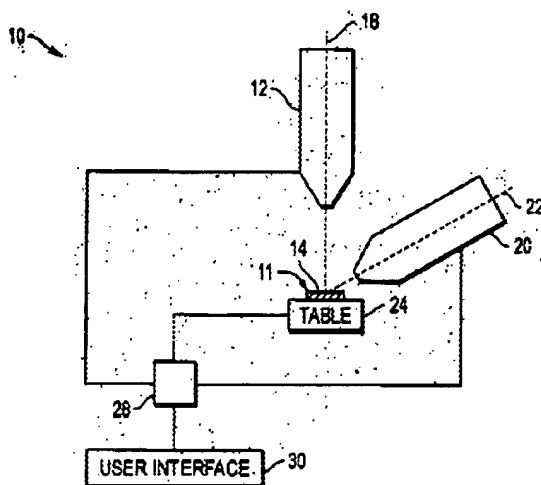


FIG. 1

Therefore it would have been obvious to one of ordinary skill in the art that the ion beam apparatus and method of Fujii (280) can be modified to use the incident electron beam angles specified in the apparatus and method of Berger (826), to provide a method and system for imaging a cross-section of a substrate that is capable of switching from a cutting mode to an imaging mode in order to view the vertical wall of the excavated cross-section.

6. Claims 6,13, and 19 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,574,280 to Fujii, in view of Christy, U.S. Patent No. 3,119,707.

Fujii (280) as described above discloses nearly all the limitations of claims 6,13, and 19, but fails to teach the use of electron beams having energy levels between 100 and 10,000 electron volts to form a metal film. However, Christy (707) discloses a method for deposition of thin films that includes the use of a substrate located within an evacuated chamber, that is enveloped with the vapor molecules of a metal-organic compound, which is irradiated with a beam of electrons accelerated at 225 volts, whereby a metal film is formed as the vapor molecules adsorbed on the substrate are decomposed by the electron beam, as recited in claims 6,13, and 19. See Column 2, line 24-32; and Column 4, line 27-40.

Therefore it would have been obvious to one of ordinary skill in the art that the ion beam apparatus and method of Fujii (280) can be modified with the accelerating potentials in the apparatus and method of Christy (707), to provide a beam of electrons directed against a vapor of metal organic molecules to form a metal film on a substrate.

Examiners Response to Arguments

7. Applicant's arguments filed 11-22-2005 have been fully considered but they are not persuasive.

Arguments 1 and 2.

Applicant states that "Therefore, contrary to the position taken in the Office Action, Applicant submits that Fujii does not teach or suggest the use of secondary electron beams, which are created when angled electron beams strike the sidewalls of the topographical features, wherein the secondary electron beams break down precursor metal gas to form a metal coating. Thus, it is Applicant's position that Fujii does not disclose or suggest the claimed feature of "directing an angled electron beam at said structure to create secondary electron beams as said angled electron beam strikes sidewalls of said topographical features, wherein said secondary electron beams break down said precursor metal gas to form a metal coating on said structure" as defined by independent claim 1.

Further, Fujii does not disclose or suggest the foregoing claimed feature wherein the "structure" is a "partially completed integrated circuit structure" as defined by independent claims 8 and 15, or wherein the "topographical features" are "vias" as defined by independent claim 15."

The applicant is respectfully directed to Fuji (280), Column 2, line 40-49, which states;

The fifth means is that an irradiation unit for irradiating with an energy beam such as a laser beam or an electron beam and an organic gas blowing unit for blowing an organic gas, which reacts with the ion beam and deposits as a hard fusing metal film, at the sample surface, are further provided to the prior apparatus. The sample surface, which is processed and/or observed by the irradiation with the focused ion beam is

blown by the organic gas and irradiated with the energy beam. The hard fusing metal film is formed on the sample by the energy beam assist CVD method.

The applicant is also respectfully directed to Matsui, U.S. Patent No. 6,758,900, a secondary reference used herein to further support Fuji's disclosure of the use of electron beams in assisted CVD deposition to cause a reaction with an organometallic gas to form a film. For example, see Column 1, line 25-28 in Matsui (900), which states; CVD based methods of producing a micro three-dimensional structure are classified into three which use light (laser), a focused electron beam, and a focused ion beam, respectively.

The applicant is further respectfully directed to Collins, U.S. Patent No. 4,509,451, an additional secondary reference describing the use of electron beams in assisted CVD film deposition. For example, see Column 2, line 13-28 in Collins (451), which states; Applicants have invented a new low temperature method to deposit and grow microelectronic thin films. The method uses d.c. electron beams to dissociate gas molecules into constituent atoms either directly by electron impact or indirectly by vacuum ultraviolet photons or finally via subsequent rare gas sensitized.

The film donor atoms so formed diffuse to a substrate surface and react to form a solid thin film. Alternatively, or in tandem, dissociation of donor molecules on the substrate surface can occur again either via electron impact or photoabsorption and film growth occurs.

Regarding the inherency that the use of an electron beam in Fuji (280) will necessarily generate secondary electrons, the applicant is respectfully directed to

Christy (707), Column 5, line 4-14, which states; Referring now to FIG., 4 there is shown a graph, which represents the number of secondary electrons emitted per primary electron versus the energy of the electron beam as expressed by the accelerating voltage. It is well known that almost all metals and some insulators will emit secondary electrons when bombarded by electrons. The number of secondary electrons emitted per primary electron depends upon such things as for example the, velocity of the primary bombarding electron and the nature, and condition of the material composing the surface being bombarded.

The examiner has interpreted from the references above that Fuji (280) clearly discloses of the use of an energy beam (either an ion beam, laser or electron beam) in assisted CVD deposition to cause a reaction with an organometallic gas to form a film, and although the bulk of the Fuji disclosure relates to the generation of secondary electrons by ion bombardment it would be understood by one skilled in the art that the use of an electron beam produces an equivalent result, as supported by the secondary references.

Conclusion


8. The Amendment filed on 11-22-2005 under 37 CFR 1.131 has been considered but is ineffective to overcome the Fuji (280), Berger (826), and Christy (707) references.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 6:30 am to 3:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (571) 272-2477. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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